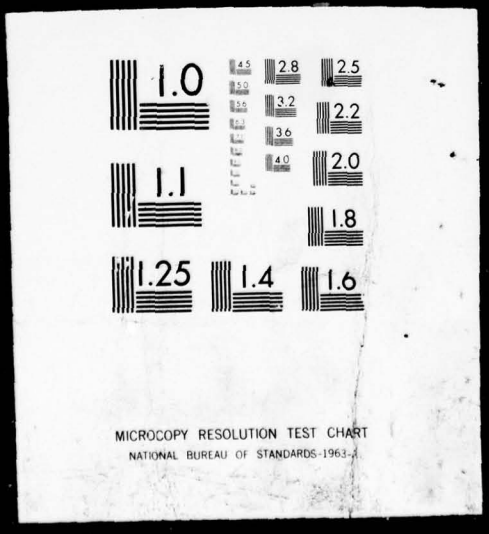
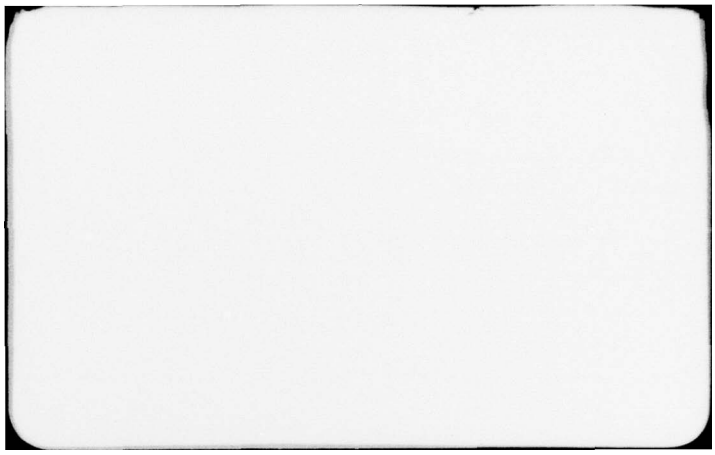
AD-A058 240 NAVAL WAR COLL NEWPORT RI CENTER FOR ADVANCED RESEARCH F/G 5/1
MAXIMIZED BENEFITS FROM MILITARY CONSTRUCTION APPROPRIATIONS.(U)
JUN 78 C L SHREVES

UNCLASSIFIED NL

1 OF 2
AD A058240





(13) LEVEL II

ADA058240

(6) MAXIMIZED BENEFITS FROM MILITARY CONSTRUCTION APPROPRIATIONS

By
(10) CHARLES L. SHREVES
Colonel, USA

(11) JUNE 1978

(9) Final rept.

(12) 119 p.

AD No. _____
DDC FILE COPY

410 268

EXECUTIVE SUMMARY

INTRODUCTION

The Armed Forces of the United States have installations and facilities in many areas of the world. Congressional appropriations for construction for fiscal year 1978 were less than one percent of the purchase price of our military facilities at the time they were placed in the inventory. If we are simply to retain the present inventory, each facility must last more than 100 years. When new missions, new weapons technology, modernization of facilities and inflation are added to the decision calculus of determining which construction projects will be approved annually, the requirement for systematic analysis of all the factors bearing on the decision rises in importance.

The intent of this study is to develop a technique to optimize the benefits from appropriations for construction by reducing the bias in the selection process. The format of the study is:

1. Definition of the major variables which impact on the decision to approve a construction project.

2. Establishing the relative merit of each such variable by evaluating questionnaire responses from Naval War College students who are similar in grade to the personnel who comprise the installation planning boards which make the decisions.

3. Development of a model which represents degrees of importance each variable is assigned for a given project.

4. Testing the model.

5. Analyzing results.

6. Conclusions and recommendations.

Variables Affecting Selection of Construction Projects

The situation, time, and place in terms of world events and geography play a role in establishing the variables which affect the outcome of a requested construction project. Known variables are:

1. commanders;

2. installations;

3. commands, and the directed/perceived missions of those commands;

4. changes in missions of units;

5. funds availability;

6. technical capability, and size of the engineering staff which will carry out a decision to construct or alter a certain facility;

7. actual or apparent urgency of the requirement;

8. the effect on safety-health-welfare, and morale;

9. external factors such as regional, political, or economic considerations, and

10. imposed programs like energy abatement and pollution control.

Present Systems of Prioritizing Projects

Systems vary among installations, commands, and services. At the individual installation level, such processes range from commanders who alone decide the priority based on personal assessments, through majority rule of a planning board composed of senior staff members, to delegation of complete authority to the installation engineer. Since the priority given a project determines if and when a project will be accomplished, it affects (1) all tenant units on an installation, (2) all installations within a major command and (3) all commands within a service. The systems used by the Army and Navy at all three levels were evaluated in an attempt to improve satisfaction of requestors who cannot understand why the priority given their project was not high enough to be funded. There is more general satisfaction with the Navy's procedure than is found in the Army because the system is well defined and understood by the "game players." However, safety is not adequately addressed and priorities are based on the potential of the project to "earn money" rather than its "true merit."

Research for a System to Quantify Merits of Projects

Any system used to prioritize construction projects involves analysis of the variables stated earlier. Therefore, the relative importance of each of the variables was established and a model developed which recognizes the degrees of difference applicable to the evaluation of each variable.

Questionnaires were prepared using the Likert technique to determine the degree of importance that Naval War College student officers associate with each variable. Some 126 (63 Navy, 22 Army, 16 Air Force, and 25 Marine) officers received questionnaires and 105 (83.3%) were returned. The results are summarized in Table I.

The next step was to assign values to the variables and define the relationship of those values to real world situations. The desire to eliminate as much bias as possible and rate each project according to the factors which make it a high priority requirement led to investigation of industry's procedure for rating the relative value of jobs of individuals. Probably the best known and most widely used job rating plan is the National Electric Manufacturers Association Job Rating Plan (NEMA).

NEMA Related to Project Evaluation

It is feasible to use the procedures of NEMA and establish a similar model for quantifying the merits of construction projects since the NEMA plan is one of the simplest and most easily understandable point-scoring plans in existence. It will not be an "exact science," but represent a business-like and objective approach to the problem, as in the case of evaluating one job against another.

The important contribution is the establishment of a model that allows an objective approach to the prioritization

TABLE I

WAR COLLEGE STUDENTS OPINION OF MILITARY CONSTRUCTION REQUIREMENTS

(105 Responses)*

VARIABLES	DEGREE OF IMPORTANCE 1 (LOW)	2	3	4	5	6	7 (HIGH)	MEAN AND MEDIAN	MODE
1. Improved Mission Accomplishment	0	2	2	3	13	32	53	6**	7
2. Safety	1	1	5	9	31	39	19	6	6
3. Command Interest	7	18	15	32	20	11	2	4	4
4. Health, Welfare, & Morale	0	1	8	20	34	35	7	5	6
5. Essentiality	0	1	1	4	13	38	48	6*	7
6. Cost Amortization	3	11	18	33	22	13	5	4	4
7. Time Restraints	1	3	12	22	28	24	15	5	5
8. External Factors	5	17	21	39	17	5	1	4	4
9. Engineering Effort	5	15	22	23	19	15	2	4	4
10. Distribution	18	34	23	20	7	2	1	3	2

*Numbers in Table represent responses selecting a particular degree of importance.

**Almost the next highest.

of projects by rating each variable and all parameters which affect the decision rather than letting one variable or bias determine the outcome.

Presented in Table II is a proposed model to quantify project evaluation based on the questionnaire results. The maximum number of points any project could receive is 392 and the minimum is 0. The degree definitions are found in Table IV of the study. The more important the impact of the variable is on the decision, the higher it is rated.

TABLE II

PROPOSED MODEL TO QUANTIFY PROJECT EVALUATION

POINTS ASSIGNED TO FACTORS AND KEY TO PRIORITIES

FACTORS	1st Degree	2nd Degree	3rd Degree	4th Degree	5th Degree
1. Improved Mission Accomplishment	0	14	28	42	56
2. Safety	0	12	24	36	48
3. Command Interest	0	8	16	24	32
4. Health, Welfare & Morale	0	10	20	30	40
5. Essentiality	0	14	28	42	56
6. Cost Amortization	0	8	16	24	32
7. Time Restraints/Urgency	0	10	20	30	40
8. External Factors	0	8	16	24	32
9. Engineering Effort	0	8	16	24	32
10. Distribution	0	6	12	18	24

Evaluation

In order to evaluate the proposed procedure, 30 projects were examined, 10 projects at each of two Army installations and 10 projects at the top of Group III (highly desirable) at the Department of the Army in the Office of the Assistant Chief of Engineers. A Project Priority Worksheet was prepared for each project to indicate the reasons for each rating. These worksheets are in Appendices B, C, and D. The results of DA projects are summarized in Table III.

Model Evaluation

Weaknesses discovered in attempting to utilize one model for all levels of command are:

1. Cost amortization data are frequently not available or presented on the DD Form 1391, Military Construction Project Data, the form used to request the project. This limits the number of projects which can be rated with this variable.

2. Time restraints would apply mostly to Minor Military Construction and Operations and Maintenance appropriations.

3. Engineering effort is not a factor for the Military Construction projects approved by Congress. Engineer districts will contract for t design.

4. Distribution could best be defined in a system that spreads funds over several investment categories or types of facilities as is done by the Navy.

TABLE III

DA PROJECTS

PROJECTS	MISSION ACCOMPLISHMENT	SAFETY	COMMAND INTEREST	HEALTH, WELFARE, MORALE	ESSENTIALITY	COST AMORTIZATION	TIME RESTRAINTS	EXTERNAL FACTORS	ENGINEER EFFORT	DISTRIBUTION	TOTAL	SYSTEM RANKING	D. A. RANKING	COST OF PROJECT(000)
1. Military Ocean Terminal, N.C.	56	0	24	0	42	0	0	24	24	24	194	1	3	1928
2. Commissary Kotterback, GY	42	24	24	0	28	0	10	0	24	12	164	2	10	946
3. Aircraft Hanger, Schwaebisch Hall, GY	14	48	24	30	0	0	10	0	24	0	150	3	4	6123
4. Bridge, Fort Campbell	14	48	24	0	0	0	10	8	8	18	130	4	8	817
5. Gym, Fort Ben	0	0	16	30	0	0	10	0	24	12	92	5	9	1600
6. Chapel, Fort Polk	0	0	16	20	0	0	10	0	24	12	82	7	6	1017
7. Electrical Distributor, Fort Lewis	14	12	16	10	0	0	10	0	8	12	82	6	5	2249
8. QM Gas Station, Korea	0	24	16	0	0	0	0	0	24	12	76	8	3	140
9. Education Center, Fort Jackson	0	0	16	30	0	0	0	0	0	0	46	9	7	3884
10. Cargo Training Facility, Fort Eustis	28	0	16	0	0	0	0	0	0	0	44	10	1	3621

Strong points emphasized by evaluating projects in accordance with the model are:

1. Essentially, when viewed in light of national security, does not apply to many projects but really emphasizes those that do.

2. The model includes command influence under Command Interest, so the total score for a project includes everything except the commander's final subjective analysis.

3. The model forced analysis of all factors in the decision process rather than allowing one or two to dominate.

4. A new perspective evolves when all projects are "measured" by the same "yardstick."

5. Final decisions on priority can now be made with full knowledge of how a project fares with respect to all others rated by a common scale.

6. Without exception, when new rankings of projects developed by the model were shown to knowledgeable personnel who had participated in the original ranking decisions, they agreed that the new rankings appeared realistic.

Conclusions

A system or model similar to the one developed in this study has application at all levels of command to prioritize

construction projects. Minor adjustments in degree definitions and points assigned to them may be required. However, while the model presented is only one of many procedural paradigms which exist in the literature of praxiology - (the science of making decisions) - it appears to be a practical, scientific and businesslike approach that can easily be adapted to the situation at any level. Use of the model will:

1. Quantify projects in a manner which reduces the bias found in subjective analysis.

2. Reduce the length of Construction Project Evaluation Committee meetings. Once evaluated, projects "fit" into a priority ranking based on a routine administrative procedure.

3. Ensure a systematic evaluation of all the parameters which impact on the decision.

4. Maximize benefits derived from meager construction appropriations.

Recommendations

The variables which determine selection of construction projects, the degree definitions, and the numerical values assigned to them are recommended for further study at each level of command where selection of the most important requirement from a list of highly desired ones is necessitated by a shortage of funds.

It is recommended that the Department of the Army form an Ad Hoc Committee to evaluate the Navy's system of prioritizing projects with a view to:

1. expanding it to include the additional variables and degrees proposed by this study;

2. correcting the tendency of the Navy system to invite subordinate commands to establish priorities based on capability to "earn money" rather than establishing true priorities;

3. correcting the fact that safety considerations are underemphasized;

4. considering the feasibility of distributing funds over several investment categories; and

5. placing the entire prioritization system on a computer program.

The expected result is a model similar to the one developed in this study.

Abstract of

MAXIMIZED BENEFITS FROM MILITARY CONSTRUCTION
AND OPERATIONAL MAINTENANCE APPROPRIATIONS

Commanders of military installations, commands and departments must select their most important construction projects each year since appropriations (Military Construction, Minor Military Construction, and Operations and Maintenance) are never adequate to fund known requirements. The selection process is normally based on subjective analysis which is influenced by the biases of individuals and the passion with which a requestor pleads his case. Research was conducted of the systems used at military installations, major commands and major claimants, Departments of the Army and Navy, and in the private sector. Variables which affect the selection process are evaluated and incorporated into a model which quantifies the merits of a project through examination of all major parameters which impact on the decision.

PREFACE

The author would like to acknowledge Dr. Chantee Lewis, Professor in the Defense Economics and Decision Making Department of the Naval War College who was my advisor for this study. Gratitude is expressed to the many people who supplied information in the Army Office of the Chief of Engineers, especially Mr. Ed Watling, Mr. Al Carton, and LTC Edwin F. Coffee, Jr.; in the Naval Facilities Engineering Command, RADM R. F. Jortberg, LCDR C. P. O'Neill, and CDR Jon Ives; in the Norfolk CINCPACFLT Engineer Staff, LCDR D. Bilden and Mr. George Brown, Jr.; in FORSCOM Engineer Staff, COL M. Northcutt and LTC R. W. Wylie; in Fort Benning, COL R. Corley; in Fort Belvoir, LTC J. King; in Fort Devens, LTC P. Stearns; in Newport Public Works, CAPT Lee Smith; in the civilian firm of Textron, Senior Vice President Robert S. Ames; and in the General Motors Corporation, Mr. A. T. Hastings, Director of Real Estate and Property Management. I appreciate the efforts of 105 of my 126 Naval War College classmates who returned my questionnaires which give credibility to the numerical system chosen to quantify the variables associated with military construction. The efforts of Mrs. Christine Anderson and Mrs. Deborah Tavares of the Center for Advanced Research, Naval War College, are appreciated for deciphering and typing this report.

For all this assistance I am most grateful and certainly share whatever attention this report may receive. They

were not, however, consulted at every phase of the report and any errors of commission or omission are those of the author alone.

TABLE OF CONTENTS

LIST OF TABLES

MAXIMIZED BENEFITS FROM MILITARY CONSTRUCTION AND OPERATIONS & MAINTENANCE APPROPRIATIONS

CHAPTER I

INTRODUCTION

Background

The Armed Forces of the United States have installations and shore facilities in many areas of the world. The value of our military facilities, based on cost at time of construction, is $80 billion for the Army, $55 billion for the Navy, and $57 billion for the Air Force.[1] If we were to assume that each facility would last 100 years, simple replacement of 1% of what we have annually would require that Congress approve $1.92 billion for construction each year for the services. The total FY 78 appropriation request for construction for all three by the Department of Defense was only $1.16 billion. New missions, increased technology which generates weapons systems that require new facilities, and simple modernization of facilities are added to the decision calculus of determining which projects will be approved annually. However, the desire for a balanced budget on the part of our legislative and executive branches will not permit appropriations for more than a fraction of what is really needed to keep from falling behind.

The Problem

Throughout the chain of command, from tenant unit to installation commander to major command to Departments of the Army, Navy, and Air Force, there are commanders who perceive requirements for construction appropriations. There will never be enough resources to satisfy these requirements. Planning Boards are convened at each level to determine the most urgently required projects and are subject to the bias of the individuals involved. Our limited resources dictate that projects be prioritized impartially.

Specifics of the Problem to be Studied

This study is intended to develop a technique to maximize the benefit from construction appropriations by reducing the bias in the selection of which projects get funded. The system used will be to determine the variables in the selection process, determine the relative merit of each of these variables (by questioning senior Naval War College officers similar in experience and grade to the personnel who make up the Planning Boards), and develop a range of values to quantify each variable.

The system used by the Navy, Army, and major civilian organizations will be analyzed for application. The model will be tested at major Army installations and at the Department of the Army.

OBJECTIVE

The objective is to provide a system which adds a new dimension to the selection of projects by enabling commanders and planners to evaluate each project with respect to all the variables. This objective ties in somewhat with the purpose of an Army Steering Committee for the Quantification of Force Readiness which is currently attempting to develop a methodology to quantify, justify, and conceptually model the relationship between resource availability and total Army force readiness.[2]

Value of an Answer

Time, personnel, and assets are finite. The construction requirements far exceed the limits of all three. Military engineers are expected to guide the decisions of commanders toward the most important projects. If we assume that each newly assigned engineer resource manager arrives with the tools necessary to cope with problems concerning the design, installation, and improvement of integrated systems of men, materials, and equipment, he still lacks guidance concerning his major problem area: priority of work accomplishment.

This study is intended to guide engineer managers and commanders. Their situations will vary depending on

level of command and geographical location. Therefore, the next chapter will discuss the variables which affect the management and selection of military construction projects.

CHAPTER II

VARIABLES AFFECTING SELECTION OF CONSTRUCTION PROJECTS

The situation, time, and place in terms of world events and geography play a role in establishing the variables which affect the outcome of a requested construction project. Known variables are:

1. commanders;
2. installations and commands, and the directed/perceived missions of those commands;
3. changes in missions of units;
4. funds availability;
5. technical capability and size of the engineering staff which will carry out a decision to construct or alter a certain facility;
6. actual or apparent urgency of the requirement;
7. the effect on safety-health-welfare and morale;
8. external factors, such as regional, political or economic considerations; and
9. imposed programs like energy abatement and pollution control.

1. Commanders. General Bruce C. Clark stated, "The personality of the commander has an enormous influence on the unit. In fact, the unit may be said to be nothing but an extension of the commander's personality."[1] As a

variable in this study, nothing else need be stated except that the personality of the commander, and his perception of what constitute his most urgent requirements, does play a role in the selection and programming of construction projects.

2. Installations and Commands. Construction requirements vary depending on the mission, geographical location, type and number of units assigned, and physical size of the installation. The mission to train recruits will require facilities which are different from those needed by a personnel and finance center or an on-line division in Europe. As can be expected, procedures for selecting and programming projects vary also. In some locations, the engineer presents a recommended order of priority which is "blessed" by the command group. In others, a panel of senior officers agonizes over the merits of each project for days.

3. Mission Changes of Units. The assignment of new missions without allocation of funds for their implementation, or at least not simultaneous with the requirement, creates serious threats to any program of construction. A strong unit commander assigned a new or additional mission will immediately attempt to have his project approved and programmed without regard to previously approved projects. It must be realized that emergency-type projects can and do occur and allowances are made for them. At the same time, urgent requirements which have been programmed cannot be ignored. In this time of technological advancement,

modernization of equipment, and changes brought about by a rapidly changing international environment, construction requirements to support these changes can be expected. The true degree of urgency for these facilities will vary.

4. Funds and Resources Available. An installation engineer can determine which construction program is most applicable for a given project based on its magnitude and his resources. For urgent requirements costing less than $100,000 (effective 1 October 1978), Operational and Maintenance (O&M) funds can be used if approved by the installation commander and adequate resources are available. For projects over this amount, or for projects for which installation assets are insufficient, the Minor Military Construction program (MMC) can be recommended. Projects are forwarded through commands to the appropriate Service's office in the Pentagon where they are grouped either as one to be approved individually by Congress or as one to be funded from a bulk allocation of funds. The monetary limitation for one project is $500,000, effective 1 October 1978. Projects costing more are placed in the Military Construction program, if the priority is deemed high enough, and presented to Congress for approval.

5. Engineering Assets. The decision to use O&M funds in number 4 above would also take into consideration the capability of the installation engineer's staff to accomplish the project and/or obligate the funds during the

current fiscal year. If the project is to be done by in-house forces, the plans and specifications may not have to be as detailed since these forces are supervised by the installation engineer who can insure that the desired quality of craftsmanship is obtained. If the project is contracted out, plans and specifications must be thorough enough to insure that the government will obtain that which is expected. Standard plans and specifications for a common facility that require little or no modification will mean less engineering effort before the contract can be awarded. This alone may determine the capability of the installation to obligate funds for a certain project during the current fiscal year.

For projects approved for Minor Military Construction funds, the capability of the supporting district engineer is an important factor. Congress requires that waivers be obtained if such a project cannot be designed within 90 days of approval and placed under contract for construction in another 90 days. Here again, the less engineering effort that must be expended, the higher the probability of meeting these deadlines.

For Military Construction projects, Congress wants 35% of the design complete before approval is requested to obligate funds. This requires that the Services select their most important projects a year in advance in order to satisfy the design requirement.

6. Urgency. The time restraints stated above must be weighed against the urgency with which the project is required in selecting which program (MC, MMC, O&M) the project should be placed into. The possibility of temporary alternative solutions to the project is also a consideration.

7. Other Variables. Safety, health, welfare, morale, essentiality (from a national point of view, such as combat preparedness requirements), and external factors will also affect the priority of the project.

Prioritizing Projects

Systems vary among installations, commands and services. At the individual installation level, such systems range from commanders who alone decide the priority based on personal assessment, through majority rule of a planning board composed of senior staff members, to delegation of complete authority to the installation engineer. Since the priority given a project determines if and when a project will be accomplished, it may affect (1) all tenant units on an installation, (2) all installations within a major command, and (3) all commands within a service. The systems used by the Army and Navy at all three levels were evaluated in an attempt to improve satisfaction of requestors who cannot understand why the priority given their project(s) was not high enough to get it funded. Also

evaluated was the system of selecting construction projects in the private sector. The methods used are discussed in the next three chapters.

CHAPTER III

PRIORITIZATION OF CONSTRUCTION PROJECTS - ARMY

Department of the Army

The Office of the Assistant Chief of Engineers (ACE) notifies each major command, i.e., Forces Command (FORSCOM) or Training and Doctrine Command (TRADOC), of the total dollar value in projects they can submit for a given program. Once received they are evaluated and initially placed in one of the following groupings. [1]

Group I. Directed. Those few projects in which the Chief of Staff, the Secretary of the Army, or the Secretary of Defense have significant interest or for which commitments to Congress have been made.

Group II. Minimum essential. Omission of the project would seriously curtail mission accomplishment or permit operations only on a hazardous basis or be a serious detriment to morale.

Group III. Highly desirable. Projects that will contribute directly to the effectiveness and efficiency of mission accomplishment, substantially increase morale or generate reductions in costs and/or personnel.

Group IV. Desirable. Projects that can be deferred with only minor inconvenience or with little adverse effect on morale.

Group V. Deferred. Exceed criteria or should be accomplished with other than MCA funds.

Group VI. Deleted.

A Construction Requirements Review Committee (0-6 level committee) meets for several days in the Pentagon and reviews the projects. The major proponents for the project (e.g., a representative from the office of the Deputy Chief of Staff for Personnel (DCSPER) defends projects for personnel activities) may recommend that their project(s) be placed in a higher priority group. Projects are then ranked within groupings. It is quite normal for all of the Group I projects to be in the program submitted to Congress. The total program within the funding range will probably end somewhere between the bottom 25% of Group II and the top 25% of Group III. This is the area where priorities are critical. The committee attempts to respect the priorities assigned by the major commands, but evaluation of worldwide requirements simultaneously does not cause them to play a significant role. One command's requirement for a maintenance facility may not be nearly as urgent as another's. Although the personnel on the Construction Requirements Review Committee are conscientious, their efforts seem to cause a lot of dissatisfaction at the major command and installation level.

Major Commands

Major commands have received guidance that the Department of the Army general priority order for FY 79 is pollution abatement, energy conservation, bachelor housing, medical facilities, maintenance facilities, training facilities, command and control facilities, and projects to improve readiness. Separate prioritized lists were to be submitted for (1) Air and Water Pollution Abatement Projects and (2) Energy Conservation Projects. All other construction projects should be included in an overall priority list for each intermediate range year.[2]

In FORSCOM, the Deputy Commanding General (3 star) is Chairman of the Command Facilities Review Board which establishes the priorities. Prior to a meeting, the FORSCOM Engineer reviews the MCA projects from each installation, groups them by facility code as outlined in Army Regulation 415-28, and sends them to the proponent staff section of the headquarters for their recommended priority. The Review Board, using the Department of the Army general priorities and programming guidance, integrates the priorities of each proponent into the command's recommended priority listing.

Dissatisfaction by the major commands with the Department of the Army Military Construction Program is apparent from the following quote from an eight star letter dated 14 March 1978 and signed by the commanding generals of both FORSCOM and TRADOC.

> ...The backlog of essential construction...and the requirement to program funds for pollution

> abatement and energy conservation have created a long-term requirement which is not being satisfactorily addressed...even if no new construction requirements are identified, at the present funding level our recognized construction needs will never be met...apparent courses of action... realign the Army funding priorities....[3]

Installations

There is dissatisfaction at the installation level because there does not appear to be correlation between the priorities recommended to the major commands and those which are forwarded to the Department of the Army or finally approved by Congress. This creates the atmosphere which permits the staff engineer to recommend a priority list which does not get much evaluation by members of the Installation Construction Review Board. Consequently, if a congressional staff member were to call and state that backing might be obtained for a particular project if it were rated near the top of the installation's priorities, that project will be moved to the top of the list.

Summary

There is general dissatisfaction within the Army concerning military construction programs. The lack of continuity in the selection process, the shortage of funds, and priorities are inconsistent with what is perceived to be that most urgently required for readiness and national defense.

CHAPTER IV

PRIORITIZATION OF CONSTRUCTION PROJECTS - NAVY

Department of the Navy

Introduction. There appears to be more general satisfaction with the Navy's distribution of construction funds because the system is well defined in a series of Navy publications that explain the prioritization process. Priorities of Major Claimants, the Army's equivalent of Major Commands (e.g., Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT), play an important role in the selection process as do four other factors. The selection process is computerized. There is some dissatisfaction in the field with the system since it "drives" the priority that must be given a project. The system is also not flexible enough to recognize some dangerous safety requirements.

Facilities Programming. The Deputy Chief of Naval Operations for Logistics, OP-04, has responsibility for military construction planning and programming. This responsibility is carried out by the Shore Facilities Programming Division, OP-44. The Naval Facilities Engineer Command functions as an extension of the OP-44 staff in providing technical assistance and automatic data processing support.

The basic concept of Multi-Year Programming (MYP) is the planned rate of correction of investment category deficiencies within an established time frame as permitted by budgetary constraints.

The identification of Navy shore facility needs begins with the Basic Facilities Requirements List (BFRL). To establish quantified statements of deficiencies, BERLS are compared with existing assets and total deficiencies are identified for existing and projected workloads.

Data pertaining to construction scope and cost of projects are developed and validated within the Shore Facilities Planning System (SFP). These data are then entered into the MILCON Requirements List (RL) which is the basic data source used for Navy Military Construction (MILCON) programming decision.

The RL has been structured to highlight:

- facilities required to support CNO or higher authority-directed initiatives;
- facilities required to support new missions, ships, aircraft or other hardware;
- facilities required to support the major claimants' needs.

Based on RL data bank information, funds are allocated among 18 investment categories, based upon Chief of Naval Operations (CNO) assessments of the significance of the project backlog in each investment category. Within investment

categories, the major claimants compete for funds on the basis of Project Rating Values (PRV) computed for each deficiency project. Five factors are considered in computing these PRVs. They are:

F_1 - Mission of the installation where the project is to be located.

F_2 - Degree of deficiency which the project will/will not satisfy or overcome.

F_3 - Type of facility, determined by DOD basic category codes for military real property.

F_4 - Economic aspects of the investment.

F_5 - Priority assigned the project by the major claimant.

A full explanation of the procedure used by the computer program to prioritize the projects is found in Navy Military Construction Programming Procedures, NAVFAC P-907, 2nd edition, October 1976. Significant is the fact that there are weights associated within each of the five factors listed above which determine its priority.

Formula. The mathematical formula of the Project Rating Value System (PRV) describes how the various factor values for a single project are weighted and combined to develop a priority rating for that project. Once priority rating

values have been developed for all projects within an investment category, the ranking by priority is established.

The additive project rating value equation in use is as follows:

$$PRV = K \sum_{i=1}^{5} W_i \quad F_i$$

K is a scaling variable used to spread project values over a greater numeric range.

W_i is a variable coefficient used to establish the relative weights of the five factors in the PRV formula. Factor weights are determined by the investment category to which the project belongs.

F_i is a variable representing the numeric value of each of the five PRV factors for a given deficiency project. Values for F_1 (Mission) and F_3 (Facility Type) are determined through use of matrices constructed from claimant supplied data. Values for F_2 (Degree of Deficiency), F_4 (Economic Value), F_5 (Claimant Priority) are determined through use of mathematical functions.

RECAP

The Navy's prioritization system looks at the entire Basic Facilities Requirements List as broken down in 18 Investment Categories. Priorities are established within each of the Investment Categories. The percent of the total program to be devoted to each Investment Category is

established. Major claimants "earn dollars" based on the total value of their projects which were above the cutoff in each category. Major claimants then reevaluate their total program and can shift priorities of projects to best suit their needs. A revised list is prepared. These projects are forwarded for ultimate approval of Congress.

Major Claimants

The engineering personnel at the major claimant level understand the system and play games with it to prioritize projects at their level. Priorities are established based on the projects potential to "earn money" rather than on its true value. Two priority lists are maintained: One is for show. The second one (informal) is the real priority once the program is established.

Major claimants conduct a Planning Board chaired at the 0-6 level. Each sub-claimant presents his priority list and justifies it. The members of the board question him about his projects but the priorities are not established. This is done later by personnel who understand the "system" and the earning potential of projects.

Since projects are prioritized within Investment Categories, the major factors which will influence the priority are (1) F_2 - degree of deficiency which the project will overcome, and (2) F_5 - priority assigned the project by the major claimant. Real dissatisfaction with the system arises

with the first one, degree of deficiency which the project will overcome, as the present condition of the facility may not be taken into consideration. For example, if the present 300 feet of ship berthing facilities are falling down and must be replaced and expanded to 1000 feet, the formula only gives credit for the difference between the 300 feet and the 1000 feet, not the whole requirement. Additionally, safety is not sufficiently recognized. An airfield that is 400 feet short can still be rated as going from 75 to 100% of the requirement which generates less points than for one going from 0 to 100%. However, you still can't use 75% of a runway that is too short to land the desired type of aircraft.

Conclusion

The Navy system of prioritizing projects is much more sophisticated than that used by the Army. It gives major commands a greater role in determining priorities and it evaluates the total Navy requirements rather than just the portion submitted for consideration for a given program. It lacks flexibility in some aspects, especially safety, and it causes the major claimants to prioritize their projects based on their potential to earn program dollars rather than true priority as perceived by commanders.

What is needed by both the Army and the Navy is a procedure to quantify the merits of projects and determine their relative priority while satisfying the shortcomings of the present system.

CHAPTER V

CONSTRUCTION IN THE PRIVATE SECTOR

General

Business investment in facilities represents a large capital outlay. Construction is inhibited by high costs while it is stimulated by the promise of improved efficiency. There is no formula to determine when new construction is warranted or would be better than renovation. The financial situation of the company, the short-term cost of capital, and prospects for the future, based on market evaluation, are the controlling factors.

Textron

Textron is a large conglomerate with its headquarters in Providence, Rhode Island. It is composed of Bell Helicopters, Bell Aerospace, Hydraulic Research, Talon, Homelite, Speidel, Gorham Silver, and many other diversified industries whose 1976 sales were $2.6 billion and net income was $121 million.

The approach of civilian industries like Textron to evaluate the merits of construction and determine priorities is based on economics - expected profit or return on investment vis-à-vis possible losses. Evaluation by successful companies is normally based on the philosophy: Don't bet the company. For example, a company may be constructing facilities, purchasing equipment and developing technology to enable it to submit a bid on a large military helicopter

contract and they opt to design cheap systems which will give them the lowest bid, should they fail to get the contract the company will fold. Therefore, they plan to use the best technology available to build the transmission and blade, the key components of any helicopter. If they do not get the contract, other markets will be available for the quality components or they can expect civilian economy buyers of their helicopter. They will not have "bet the company" in a win or lose all situation.

Additional factors that the Senior Vice President of Textron indicated are evaluated include the geographical area of the country, its economy, state and local tax structure, demography, energy, resources, and attitudes. One particular area of the U.S. has not developed an industrial base to nearly its potential because of high tax structures, unions, unemployment funds used to pay retirees and strikers, and worker attitudes not as good as found elsewhere. A company would not build a plant there because other parts of the country offer better opportunities.[1]

General Motors

The facilities of General Motors include 120 plants in 21 states and 77 cities in the United States, seven plants in Canada, and assembly, manufacturing, distribution or warehousing operations in 33 other countries. GM factory sales worldwide in 1976 totaled 8,568,000 units.

Variables considered when evaluating construction projects, according to GM's Chief of Real Estate, are environmental aspects, utilities and power sources available, resources of raw materials and scrap metal, labor force available in the area, political implications such as local and state influence, tax benefits, worker's compensation requirements, and the effect the new facility will have on the economic welfare of the company in the future, especially its influence in meeting anticipated governmental regulatory requirements. A task force is formed from each of the affected departmental staff sections to evaluate each project proposed by a department head who himself can approve minor projects costing less than $100,000.[2]

After the Chief of Real Estate reviewed the variables outlined in Chapter II, he went through each one and confirmed that they were considerations for GM projects too. It was clear, however, that the definitions he presented varied somewhat from what the author had in mind for government projects. The basic fact that industry is profit-oriented, while the military is defense and national security-oriented, causes different interpretations of essentiality, mission improvement and safety. Similarities occur in cost amortization, time restraints, engineering effort and external factors. Distribution applies more to diversification than to distributing the assets.

Summary

Industry evaluates projects by quantifying their merits in relation to expected economic gain. They look at all the parameters which affect the decision and do not allow individual biases to exert inordinate degrees of influence.

The civilian industry's economic analysis is limited in its application for the military because of the non-profit aspect. The data concerning location of industry geographically would have application for military studies concerning opening or closing installations. The final decision here may be based more on external factors and politics than on economics however.

CHAPTER VI

RESEARCH FOR A SYSTEM TO QUANTIFY AND ESTABLISH PRIORITIES

Any system used to prioritize construction projects involves analysis of the variables listed in Chapter II. Therefore, the relative importance of each of the variables must be established and a model developed which recognizes the degrees of difference applicable to the evaluation of each variable.

Questionnaires

Two questionnaires were prepared using the Lickert principle to determine the degree of importance that Naval War College officers associate with each variable. One of the questionnaires was placed on the desk of each of the 126 military members of the Naval War College student body (Class of 78). All students were either 0-5's or 0-6's. There were 63 Navy, 22 Army, 16 Air Force, and 25 Marine officers who received questionnaires. The second questionnaire had the variables to be rated arranged in random order to determine if the results would be biased by the order in which variables were listed. The questionnaires were to be returned to either my desk in the student area or to a box in the mailroom marked for that purpose. Samples of questionnaires are in Appendix A. The first 70 names alphabetically received Questionnaire #1 and the remaining 56 received #2.

Of the 126 questionnaires, 105 (83.3%) were returned, (56 from Questionnaire #1 and 49 from #2). Since officers had the option of tearing off the cover sheet which had their name on it, and many did, no trends could be established concerning why the other 21 officers did not return the questionnaire. The results of the questionnaires are tabulated in Tables I, II, and III. The numbers represent the total number of officers who selected each degree of importance attached to each variable. Differences in ratings between the two questionnaires were slight and insignificant.

Analysis of the results of the questionnaires led to the following ranking of the variables from highest to lowest degree of importance as seen through the perceptive filters of Naval War College students.

1. Improved Mission Accomplishment
2. Essentiality
3. Safety
4. Health, Welfare, and Morale
5. Time Restraints
6. Cost Amortization
7. Command interest
8. Engineering Effort
9. External Factors
10. Distribution

There is no significant difference in the first two. Safety stands alone. The rankings of Health, Welfare, and Morale and

TABLE I

RESULTS OF QUESTIONNAIRE #1: WAR COLLEGE STUDENTS

OPINION OF MILITARY CONSTRUCTION REQUIREMENTS

(56 Responses)

VARIABLES	DEGREE OF IMPORTANCE 1 (LOW)	2	3	4	5	6	7 (HIGH)	MEAN AND MEDIAN	MODE
1. Improved Mission Accomplishment	0	1	0	0	5	17	33	7	7
2. Safety	1	0	3	5	13	22	12	6	6
3. Command Interest	4	10	4	17	17	3	1	4	4&5
4. Health, Welfare, & Morale	0	0	6	12	19	17	2	5	5
5. Essentiality	0	1	1	3	7	19	25	6	7
6. Cost Amortization	1	6	13	14	14	6	2	4	4&5
7. Time Restraints/ Urgency	0	1	9	12	16	11	7	5	5
8. External Factors	4	10	11	20	8	3	0	4	4
9. Engineering Effort	3	9	13	12	10	8	1	4	3
10. Distribution	8	15	15	13	4	0	1	3	2&3

TABLE II

RESULTS OF QUESTIONNAIRE #2: WAR COLLEGE STUDENTS

OPINION OF MILITARY CONSTRUCTION REQUIREMENTS

(49 Responses)

VARIABLES	DEGREE OF IMPORTANCE 1 (LOW)	2	3	4	5	6	7 (HIGH)	MEAN AND MEDIAN	MODE
1. Distribution	10	19	8	7	3	2	0	2	2
2. Engineering Effort	2	6	9	11	9	7	1	4	4
3. Essentiality	0	0	0	1	6	19	23	6	7
4. Time Restraints	1	2	3	10	12	13	8	5	6
5. Safety	0	1	2	4	18	17	7	5	5&6
6. Health, Welfare, & Morale	0	1	2	8	15	18	5	5	6
7. Improved Mission Accomplishment	0	1	2	3	8	15	20	6	7
8. Cost Amortization	2	5	5	19	8	7	3	4	4
9. Command Interest	3	8	11	15	3	8	1	4	4
10. External Factors	1	7	10	19	9	2	1	4	4

TABLE III

CONSOLIDATED RESULTS OF TABLES I AND II: WAR COLLEGE STUDENTS OPINION OF MILITARY CONSTRUCTION REQUIREMENTS

(105 Responses)

VARIABLES	DEGREE OF IMPORTANCE 1 (LOW)	2	3	4	5	6	7 (HIGH)	MEAN AND MEDIAN	MODE
1. Improved Mission Accomplishment	0	2	2	3	13	32	53	6*	7
2. Safety	1	1	5	9	31	39	19	6	6
3. Command Interest	7	18	15	32	20	11	2	4	4
4. Health, Welfare, & Morale	0	1	8	20	34	35	7	5	6
5. Essentiality	0	1	1	4	13	38	48	6*	7
6. Cost Amortization	3	11	18	33	22	13	5	4	4
7. Time Restraints	1	3	12	22	28	24	15	5	5
8. External Factors	5	17	21	39	17	5	1	4	4
9. Engineering Effort	5	15	22	23	19	15	2	4	4
10. Distribution	18	34	23	20	7	2	1	3	2

* Almost the next highest.

Time Restraints are essentially equal. Numbers 5, 6, 7, and 8 are closely related. Number 10 stands alone as the least significant factor.

The next step in quantifying the variables was to assign values and define the relationship of the values to real world situations to develop the model. The desire to eliminate bias and rate each project according to the factors which make it a high priority requirement led to investigation of industry's procedure for rating the relative value of jobs of individuals. Probably the best known and most widely used job rating plan is the National Electric Manufacturers Association Job Rating Plan (NEMA).[1]

NEMA Related to Project Evaluation

It should be possible to use the procedures of NEMA to establish a similar model for quantifying the merits of construction projects since the NEMA plan is one of the simplest and most easily understandable point-scoring plans in existence. It will not be an "exact science," but represent a business-like and objective approach to the problem, as is the case in evaluating one job against another.

The first step in preparing this model is to determine degree definitions and assign values for each. When using the model later, the first step will be to thoroughly brief the Construction Program Review Committee on the factor and degree definitions so that all have the same interpretation of them. In some circumstances, it may be necessary to decide by committee vote on changes to the values and/or degree definitions desired. The important contribution

here is the establishment of a model that allows a scientific approach to the prioritization of projects by rating each variable and all parameters which affect the decision rather than letting one variable or bias determine the outcome.

Presented in Table IV is a proposed model to quantify project evaluation based on the questionnaire results. The maximum number of points any project could receive is 392 and the minimum is 0.

The next step is to evaluate the model at different levels of command.

TABLE IV

PROPOSED MODEL TO QUANTIFY PROJECT EVALUATION

POINTS ASSIGNED TO FACTORS AND KEY TO PRIORITIES

FACTORS	1st Degree	2nd Degree	3rd Degree	4th Degree	5th Degree
1. Improved Mission Accomplishment	0	14	28	42	56
2. Safety	0	12	24	36	48
3. Command Interest	0	8	16	24	32
4. Health, Welfare & Morale	0	10	20	30	40
5. Essentiality	0	14	28	42	56
6. Cost Amortization	0	8	16	24	32
7. Time Restraints/Urgency	0	10	20	30	40
8. External Factors	0	8	16	24	32
9. Engineering Effort	0	8	16	24	32
10. Distribution	0	6	12	18	24

1. Improved Mission Accomplishment: This factor measures the affect the project will have on the ability of the requesting unit to perform its assigned mission.

1st degree: Mission accomplishment not affected.

2nd degree: Mission accomplishment capability improved less than one-third.

3rd degree: Mission accomplishment capability improved more than one-third but less than two-thirds.

TABLE IV (continued)

4th degree: Mission accomplishment capability improved more than two-thirds, or allows accomplishment of a unit mission assigned by a higher headquarters which cannot be accomplished without this project.

5th degree: Mission assigned by Department of the Army or higher which requires that this project be accomplished to meet requirements of a specific or special program.

2. Safety: This factor measures the possible injury to personnel or equipment if the project is not accomplished.

1st degree: Safety is not a consideration.

2nd degree: Reasonable care would prevent accidents.

3rd degree: Compliance with strict safety rules or special requirements needed until this project is completed.

4th degree: Constant attention required to prevent accidents.

5th degree: Possible loss of life, serious injury to personnel, or damage to equipment exceeding cost of project possible.

3. Command Interest: This factor measures the project as viewed by top management. Point values and degree definitions may vary with commands. Generally, it is used to grant bonus points to projects in which top management has expressed definite interest.

TABLE IV (continued)

1st degree: A project supported by the commanders at the next level above the requesting unit.

2nd degree: Expressed interest by commanders at two levels higher than requesting unit.

3rd degree: Expressed interest by installation commanders or three levels higher than requesting unit.

4th degree: Command interest strong enough to make accomplishment this year desirable.

5th degree: One of the highest priority projects for the year which top management desires started immediately.

4. Health, Welfare and Morale: This factor measures the surroundings desired corrected by the project and the effect of the surroundings on troop morale. Consider the presence, relative amount of, and continuity of exposure to dust, dirt, heat, fumes, cold, noise, vibration, wetness, etc. Don't confuse with safety.

1st degree: Ideal conditions, complete absence of disagreeable elements, or not applicable.

2nd degree: Good conditions. May involve occasional exposure to some of the elements listed above, or occasional disagreeable circumstances. Morale affected marginally.

TABLE IV (continued)

3rd degree: Somewhat disagreeable conditions due to exposure to one or more of the elements listed, but where exposure is not constant.

4th degree: Continuous exposure to several disagreeable elements or one particularly disagreeable element. Morale will be seriously affected if not corrected.

5th degree: Continuous and intensive exposure to several disagreeable elements. A morale problem requiring urgent attention.

5. Essentiality: This factor measures the direct contribution of the project to national security and would expect to give highest ranking to improved capability or readiness with respect to national defense, i.e., special weapons storage, air defense, communications sites, satellite tracking stations, intelligence gathering activities, etc. For overseas areas consider capability to perform the General Defense Plan (GDP).

1st degree: Not a consideration.

2nd degree: Capability to perform national security or defense mission is affected and the project would improve the U.S. position.

3rd degree: Improved capability for accomplishing GDP mission for one or more battalions, or capability improved by up to 50%.

TABLE IV (continued)

4th degree: Greatly improved capability to perform essential national security or defense requirement, or improved GDP capability for one or more brigades.

5th degree: Absolutely essential and would immediately improve national security.

6. Cost Amortization: This factor measures the length of time required to amortize the cost of the project. Consideration should be given to savings in time for personnel or in the case of utility systems and similar projects, the savings because of reduced operating costs.

1st degree: Cost of the project would be amortized over a long period of time, not applicable, or cost amortization information not available.

2nd degree: Cost of project will be amortized in 3 years.

3rd degree: Cost of project will be amortized in more than 2 but less than 3 years.

4th degree: Cost of project will be amortized in more than 1 but less than 2 years.

5th degree: Cost of project will be amortized in less than 1 year.

7. Time Restraints/Urgency: This factor considers that a project's urgency can vary with the passage of time and considers time available before design and construction must be

started. Minor construction projects (by law) must have design completed within 90 days of approval by Congress and construction started 90 days later. Projects financed with operations and maintenance funds (O&M) must be obligated before the end of the fiscal year and become more or less urgent as capability to obtain an acceptable contract within the time limit is measured against other projects.

1st degree: Project is not an urgent requirement.

2nd degree: Alternative facilities are available that, although inefficient or sub-standard, would permit the project to be delayed until the next fiscal year's program.

3rd degree: Six months to one year are available after approval before this project must be placed under contract.

4th degree: Less than six but more than three months are available before this project must be placed under contract.

5th degree: Three months or less are available before this project must be placed under contract.

8. External Factors: This factor considers political interests, public relations, requirements with federal, state, or local interest such as environment, labor unions, or impact this project could have on others outside the requesting service.

1st degree: Others outside of requesting service are not affected.

TABLE IV (continued)

2nd degree: External interests will be affected but tact and careful handling should control it.

3rd degree: External factors will play an important role in the decision to do or not do this project.

4th degree: (A) Failure to accomplish this project will result in unfavorable public image caused by pickets, press releases, etc., or
(B) Highly favorable atmosphere will be created externally.

5th degree: (A) Failure to accomplish this project will result in court case and/or severe public criticism of the command or service, or
(B) Accomplishment will result in high praise and favorable public image.

9. Engineering Effort: This factor measures the relationship of the engineering effort required to prepare the plans and specifications or accomplish the work in-house or by contract, and considers the limited staff of the engineer and his requirement to maximize accomplishment of design in order to increase construction placement.

1st degree: Preparation of detailed technical plans and specifications required which will cause a real drain on the engineer effort available.

TABLE IV (continued)

2nd degree: Project for which standard specifications are not available or, if available, require extensive modification.

3rd degree: Project will be accomplished by engineer in-house work force and require less detailed specifications.

4th degree: Engineer has standard specifications available and can program project in routine manner.

5th degree: Engineer effort minimal.

10. Distribution of Project: This factor measures the desireability of spreading limited assets around over several installations or projects versus the accomplishment of only the highest priority projects regardless of cost or location.

1st degree: Not a factor being considered in the evaluation of this project.

2nd degree: Distribute the projects over several installations or areas to satisfy the greatest number of people.

3rd degree: Recognizes that distribution of assets can placate many opposing factions, but accomplishes vital projects also.

4th degree: The most important projects only will be accomplished unless extreme circumstances warrant special consideration.

TABLE IV (continued)

5th degree:	Only accomplish the projects most urgently needed for the defense or welfare of the nation, service, or area regardless of their location.

CHAPTER VII

EVALUATION OF THE PROPOSED MODEL

Procedure

In order to evaluate the proposed procedure, 30 projects were evaluated, ten at each of two Army installations and ten at the top of Group III (highly desirable) at the Department of Army. No attempt was made to rank projects at the Navy installations since gamesmanship, the ability of the project to "earn money," determines the priority instead of the biases of individual commanders or their staffs.

A Project Priority Worksheet was developed and prepared for each project to indicate the reasons for each rating. These worksheets are in Appendices B, C, and D. The results are summarized in Tables V, VI, and VII. For a Construction Program Review Committee meeting, engineer technicians could have prepared these forms from the data on the DD Forms 1391, or from the DA Form 2701, or its equivalent at the installation level. Each project can be evaluated by the Committee with the project proponent present to verify or question the evaluation. Ranking the projects in a manner similar to Tables V, VI, and VII becomes a simple mechanical process.

Model Evaluation

Weaknesses discovered in attempting to utilize one model for all levels of command are:

TABLE V

DA PROJECTS

PROJECTS	MISSION ACCOMPLISHMENT	SAFETY	COMMAND INTEREST	HEALTH, WELFARE, MORALE	ESSENTIALITY	COST AMORTIZATION	TIME RESTRAINTS	EXTERNAL FACTORS	ENGINEER EFFORT	DISTRIBUTION	TOTAL	SYSTEM RANKING	D. A. RANKING	COST OF PROJECT(000)
1. Military Ocean Terminal, N.C.	56	0	24	0	42	0	0	24	24	24	194	1	3	1928
2. Commissary Kotterback, GY	42	24	24	0	28	0	10	0	24	12	164	2	10	946
3. Aircraft Hanger, Schwaebisch Hall, GY	14	48	24	30	0	0	10	0	24	0	150	3	4	6123
4. Bridge, Fort Campbell	14	48	24	0	0	0	10	8	8	18	130	4	8	817
5. Gym, Fort Ben	0	0	16	30	0	0	10	0	24	12	92	5	9	1600
6. Chapel, Fort Polk	0	0	16	20	0	0	10	0	24	12	82	7	6	1017
7. Electrical Distributor, Fort Lewis	14	12	16	10	0	0	10	0	8	12	82	6	5	2249
8. QM Gas Station, Korea	0	24	16	0	0	0	0	0	24	12	76	8	3	140
9. Education Center, Fort Jackson	0	0	16	30	0	0	0	0	0	0	46	9	7	3884
10. Cargo Training Facility, Fort Eustis	28	0	16	0	0	0	0	0	0	0	44	10	1	3621

Remarks: This system of ranking projects based on the rating of variables appears more realistic. Insufficient data were available for the projects rated to determine economic and cost amortization information. Note that these projects were taken from the top of the Group III listing where priority begins to become important as funds available determine the cut off point.

TABLE VI

FORT DEVENS PROJECTS

	Improve Mission Accomplishment	Safety	Command Interest	Health, Welfare & Morale	Essentiality	Cost Amortization	Time Restraints	External Factors	Engineering Effort	Distribution	Total Points	System Ranking	Fort Devens Ranking	Cost of Project (000)
1. POL Storage	0	48	16	0	0	0	10	0	24	24	122	2	1	75
2. Ed. Center	14	0	8	30	0	0	0	16	8	12	88	8	2	25
3. Photo Lab	28	24	24	30	0	0	0	0	32	18	156	1	3	1.5
4. PT Facility	14	12	8	30	0	0	0	0	24	12	10[illegible]	7	4	5
5. MISO Tapes Storage	56	0	16	0	0	0	10	16	16	6	120	3	5	6.25
6. S-2 Wardroom	56	0	24	0	0	0	10	0	8	18	116	4	6	10
7. Law Research	28	0	8	30	0	0	10	0	16	12	104	5	7	4
8. Finance Eff.	28	0	8	20	0	0	0	0	8	6	70	10	8	6.5
9. Audiovisual	42	0	24	0	0	8	10	0	0	0	84	9	9	70
10. Motor Pool	28	12	8	20	0	0	0	0	24	12	104	6	10	20

Remarks: It appears that the ranking based on this system of rating variables is more realistic than the one by subjective analysis. Ranking the Education Center project as their second most important of the projects given me to evaluate does not appear realistic when compared with hard requirements like the MISO tape storage and S-2 war room requirements.

This analysis suggests that essentiality may not be applicable as written for an installation. Not enough cost amortization data were available. Time restraints will only become a real factor as the end of the fiscal year draws near.

TABLE VII

FORT BENNING PROJECTS

	Improved Mission Accomplishment	Safety	Command Interest	Health, Welfare & Morale	Essentiality	Cost Amortization	Time Restraints/ Urgency	External Factors	Engineering Effort	Distribution	TOTAL	Fort Benning Ranking	System Rankings	Cost of Project (000)
1. Highway Crossing	0	24	24	20	0	0	10	8	0	0	86	1	9	3772
2. Reception Station Admin	14	0	16	20	0	0	10	16	24	12	112	2	7	6687
3. Reception Barracks & Dining	14	0	16	20	0	0	10	16	24	12	112	3	6	7183
4. Tactical Equipment Shop	28	12	16	30	0	0	0	0	24	12	122	4	4	8340
5. Trainee Barracks	56	0	16	20	0	0	10	16	24	18	160	5	2	15988
6. Ammo Storage Igloos	56	48	32	0	14	0	10	16	24	24	224	6	1	4436
7. Fire Station	42	48	16	0	0	0	10	0	24	12	152	7	3	367
8. Enlisted Service Center	0	0	16	20	0	0	0	0	24	0	60	8	10	2103
9. DA Reqr. Fuel Storage Tanks	56	0	24	0	0	0	0	0	32	6	118	9	5	452
10. Range Control Complex	14	24	16	0	0	0	10	0	24	12	100	10	8	2096

Remarks: It appears that the ranking based on a system of rating variables is more realistic, especially after one visits the project sites. It is possible that external political factors exist for the highway project that are not apparent from reading the DA Form 1391. Economics and cost amortization data was not available. Essentiality of a project when viewed nationally does not apply often on a single installation.

1. Cost amortization data is frequently not available or presented on the DD Form 1391, Military Construction Project Data, the form used to request the project.

2. Mission accomplishment definitions are quite strong. Consider the 4th degree definition which states "...allows accomplishment of a unit mission assigned by a higher headquarters which cannot be accomplished without this project." Few commanders will admit that they cannot accomplish anything. The degree of efficiency with which they accomplish it may be more applicable.

3. Time restraints would apply mostly to Minor Military Construction and Operations & Maintenance appropriations.

4. Engineering effort is not a factor for the Military Construction projects approved by Congress. Engineer districts will contract for the design.

5. Distribution could best be defined in a system that spreads funds over several investment categories or types of facilities as is done by the Navy.

Strong points emphasized by evaluating projects in accordance with the model are:

1. Essentiality, when viewed in light of national security, does not apply to many projects but really emphasizes those that do.

2. The model includes command influence under Command Interest, so the total score for a project includes everything except the commander's final subjective analysis.

3. The model forced analysis of all factors in the decision tree rather than allowing one or two to dominate.

4. A new perspective evolves when all projects are "measured" by the same "yardstick."

5. Final decisions on priority can now be made with full knowledge of how a project fares with respect to all others rated by a common scale.

6. Without exception, when the new rankings of projects developed by the model were shown to knowledgeable personnel who had participated in the original ranking decisions, they agreed that the new rankings appeared realistic.

Application

A system or model similar to the one developed in this study has application at all levels of command. Minor adjustments in degree definitions and points assigned to them may be required. However, while the model presented is only one of many procedural paradigms which exist in the literature of praxiology--the science of making decisions, it appears to be a practical, scientific and business-like approach that can be easily adapted to the situation at any level.

> The fact that a fallacy has been found in a particular study does not necessarily invalidate the work, for it may be corrected. And the very fact that someone can point out where a systems analysis has gone wrong strongly attests to the value of the approach. It is thus a serious

> mistake not to make any analysis and the judgments on which it depends explicit. For if they are not, we surrender the three great advantages that the analytic approach has over its competition - namely, that someone else can examine the work, can evaluate it, and can modify it as new information or insight becomes available.[1]

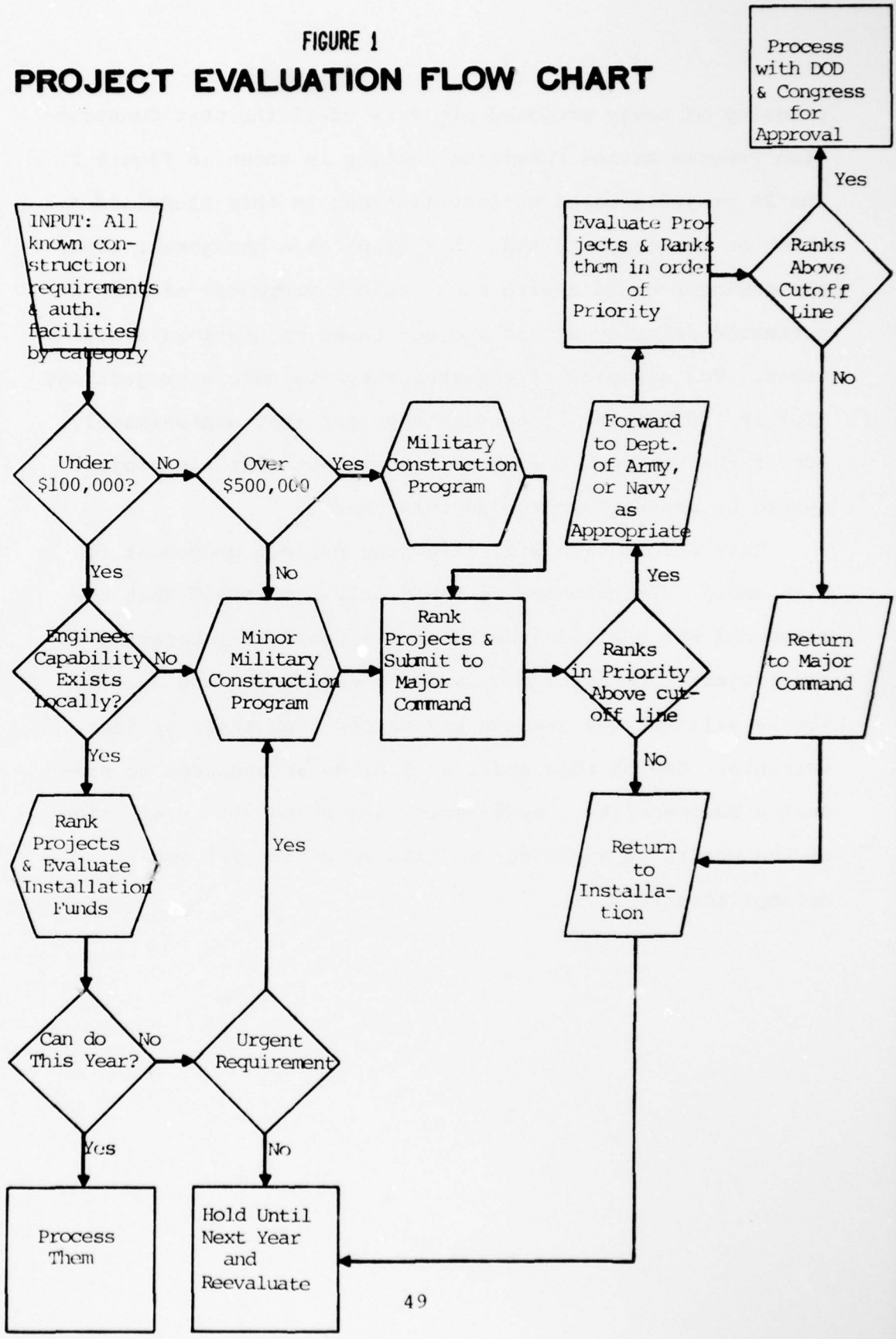
An installation commander or his engineer could evaluate all requirements for construction of his installation, utilize a flow chart such as Figure 1 to analyze them and put them in the proper program, then rank them in accordance with the definitions outlined in the model, Table IV. At the major command or major claimant level, proponent views could be heard but overall value of projects when ranked by a fair system should go far to eliminate dissatisfaction. At the Department of the Army level, each project could be received with a project evaluation form attached. It would, of course, have to be consistent with the definitions and the data shown in the DD Form 1391. An added benefit expected would be improvements in the justification used on the DD Forms 1391. Once evaluated, ranking the projects would be much simpler than the present laborious one of conducting meetings for 15 or more days as was necessary to rank 264 projects for FY 80 and 512 projects for FY 81.

Dynamic Management

A simple chart which can be prepared and used by engineers at each level of command to evaluate the expected

FIGURE 1

PROJECT EVALUATION FLOW CHART

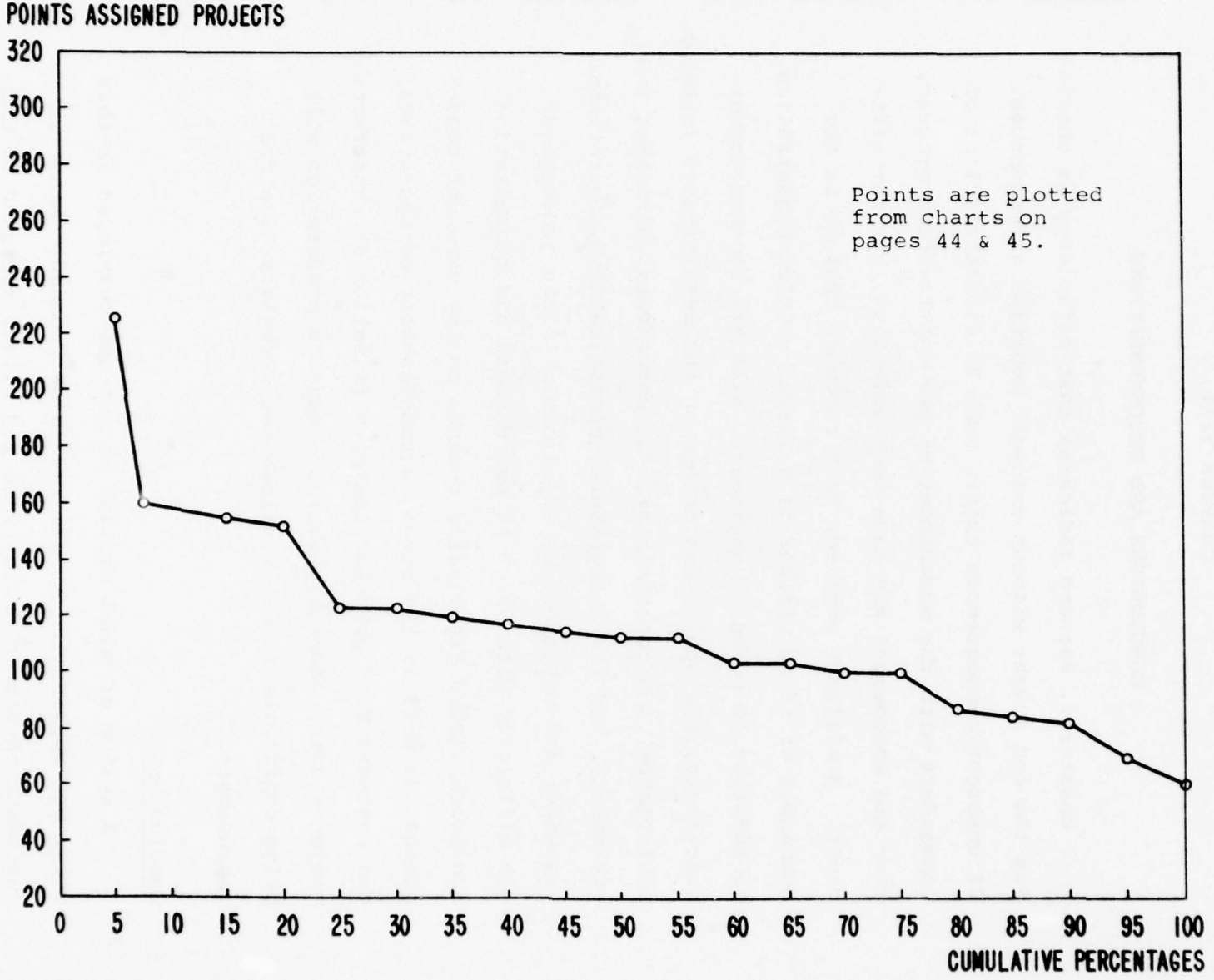


priority of newly proposed projects until the next Construction Program Review Committee meeting is shown in Figure 2. The 20 projects rated at installations in this study are shown on the chart. Using this graph as a management tool, the engineer could advise each project proponent of the estimated priority of his project based on previous evaluations. For example, if together they evaluate a project and give it 150 points, it becomes apparent that approximately 20% of the projects are rated higher, but that his project should be among those funded this year.

This information will allow the project proponent to plan ahead. Previously, he could only have hoped that the personnel who comprise the committee would be interested in his project. Personal bias will be eliminated and squeaky wheels will not get greased any better than their project warrants. Use of this chart will allow an engineer to present a businesslike, systematic, and pbjective evaluation of the merits of a project and its potential for early accomplishment.

FIGURE 2

PROJECT POINTS AND CUMULATIVE PERCENTAGE CHART



CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

Chester I. Barnard indicates that efficiency is obtaining the end sought without unsought negative consequences.[1] If unsought consequences exist, such as dissatisfaction of commanders with the management of the construction program, then the management may have been effective, but not efficient. A military engineer must remember that he is the commander or staff officer of a large, complex organization, in addition to being an engineer. Like all top management executives, his operations depend on the determinants (mission, performance, and constraints), the components (personnel and equipment), and the integrators (communications, operational sequence, and decisions by superiors). Since judgment of the efficiency with which he has managed his organization and accomplished his mission depends on the unsought consequences as well as the sought accomplishment of objectives, the engineer must approach the prioritization of construction projects after careful planning. Advance preparation will bring confidence since it allows the necessary time for improvement.[2]

Conclusions

A system or model similar to the one developed in this study has application at all levels of command. Minor adjustments in degree definitions and points assigned to them

may be required. The merit of this study is in the development and testing of the model. Use of the model will:

1. Quantify projects in a manner which reduces the bias found in subjective analysis.

2. Reduce the length of Construction Project Evaluation Committee meetings. Once evaluated, projects "fit" into a priority ranking based on a routine administrative procedure.

3. Ensure a systematic evaluation of all the parameters which impact on the decision.

4. Maximize benefits derived from meager construction appropriations.

Recommendations

The variables which determine selection of construction projects, the degree definitions, and the numerical values assigned to them are recommended for further study at each level of command where selection of the most important requirement from a list of highly desired ones is necessitated by a shortage of funds.

It is recommended that the Department of the Army form an Ad Hoc Committee to evaluate the Navy's system of prioritizing projects with a view to expanding it to include the additional variables and degrees proposed by this study, correct the tendency of the Navy system to invite subordinate commands to establish priorities based on capability to "earn money" rather than establishing true priorities, correct

the fact that safety considerations are underemphasized, and consider the feasibility of distributing funds over several investment categories while placing the entire prioritization system on a computer program. The expected result is a model similar to the one developed in this study.

NOTES

Chapter I

1. Real Property Maintenance Activities Study, prepared by study group under General Donald G. Weinferti, Office of the Chief of Engineers, March 1978, Vol. I, p. 5.

2. Chief of Staff Memorandum, U.S. Army, subject: Quantification of Force Readiness, 28 April 1977.

Chapter II

1. Bruce C. Clark, Guidelines for the Leader and Commander (Harrisburg, Pennsylvania: Stackpole Company, 1964), p. 14.

Chapter III

1. Interview, LTC Edwin F. Coffee, Jr., Office of the Assistant Chief of Engineers, April 1978.

2. Letter, DAEN-MCP-B, HQDA, 5 October 1977, subject: FY 1978 MCA Program.

3. Letter, DA, HDQ, United States Army Forces Command and HDQ, United States Army Training and Doctrine Command, 14 March 1978 to General Rogers, Chief of Staff.

Chapter V

1. Interview, Mr. Robert S. Ames, Senior Vice President for Textron, 18 April 1978.

2. Interview, Mr. A. T. Hastings, Chief of Real Estate for General Motors, 30 May 1978.

Chapter VI

1. David W. Belcher, Wage and Salary Administration (Prentice Hall, Inc: New Jersey, 1955), p. 289.

Chapter VII

1. E. S. Quade, Pitfalls and Limitations, an extract from Systems Analysis and Policy Planning: Applications in Defense, A report prepared for U.S. Air Force Project Rand, R-439-PR (Abridged), June 1968, p. 4.

Chapter VIII

1. Chester I. Barnard, The Functions of the Executive (Cambridge, Massachusetts: Harvard University Press, 1966), p. 19.

2. N. Maier and J. Hayes, Creative Management (New York: McGraw Hill, 1964), p. 54

BIBLIOGRAPHY

Management and Engineering

Barnard, Chester I. The Functions of the Executive. Cambridge, Massachusetts: Harvard University Press, 1966.

Belcher, David W. Wage and Salary Administration. New Jersey: Prentice Hall, Inc., 1955.

Clark, Bruce C. Guidelines for the Leader and Commander. Harrisburg, Pennsylvania: Stackpole Company, 1964

Drucker, Peter F. The Practice of Management. New York: Harper Brothers, 1954.

Koontz, Harold and O'Donnel, Cyril. The Principles of Management. New York: McGraw Hill, 1968.

Lawrence, Paul R. How to Deal with Resistance to Change, Harvard Business Review, January-February 1969.

Maier, N. and Hayes, J. Creative Management. New York: John Wiley and Sons, 1962.

McLain, Chalres I and Lewis, Chantee. A Treatment of Time-Phased Costs. Selected readings in Defense Economics and Decision Making, Naval War College.

McLain, C.I. Measurables and Unmeasurables: Commensuables and Incommensurables. Selected readings in Defense Economics and Decision Making, Naval War College.

Quade, E.S. and Boucher, W.I. Pitfalls and Limitations. An extract from Systems Analysis and Policy Making: Applications in Defense. Selected readings in Defense Economics and Decision Making, Naval War College.

Quade, E.S. Principles and Procedures of Systems Analysis. An extract from Systems Analysis and Policy Making: Applications in Defense. Selected readings in Defense Economics and Decision Making, Naval War College

Shirkey, Charles P. Faculty Technical Note on Characteristics of Bureaucratic Organizations: A Management Perspective. Selected readings in Defense Economics and Decision Making, Naval War College.

Sloane, S.B. The Management of Time. Selected readings in Defense Economics and Decision Making, Naval War College.

Vroom, Victor H. A New Look at Managerial Decision Making. Selected Readings in Defense Economics and Decision Making, Naval War College.

West, F.J. Jr. Tasks of SECDEF As A Manager. Selected Readings in Defense Economics and Decision Making, Naval War College.

Government Publications

Army Regulation 210-10, Installations-Administration.

Army Regulation 415-15, Military Construction, Army (MCA) Program Development.

Army Regulation 415-31, Basic Facilities and Space Allowance for Peacetime Missions at Army Installations.

Army Regulation 415-35, Minor Construction.

Naval Facilities Engineering Command, NAVFAC P-328, Military Construction Program Management.

Naval Facilities Engineering Command, NAVFAC P-907, Naval Military Construction Programming Procedure.

Naval Facilities Command, NAVFAC INST 11010.44C, Shore Facilities Planning Manual.

Office of the Chief of Naval Operations. Instruction 11010.1H, Policies, Responsibilities, and Procedures for Military Construction Planning, Programming, and Budgeting.

Defense Department Documentation Center Studies

Erlenkotter, Donald and Rogers, J. Scott. Sequencing Competitive Expansion Projects. Western Management Suence Institute, University of California, June 1975.

Fuelling, Clinton O. Simulation and Gaming Methods for Analysis of Logistics (SIGMALOG): Theater Construction Model. Research Analysis Corporation, McLean, Virginia, May 1970.

Grum, Allen F. An Examination of Methods of Allocating Research, Development, Test, and Evaluation Funds Among Competing Projects. Army War College, Carlisle Barracks, PA, February 1971.

Kibble, J. et. al. Top-Man X: A Management Simulation for Instruction in Total Programming and the Base Engineer Automated Management System (BEAMS). Civil Engineering School of the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio, September 1969.

Kirby, Jeffrey G. Life Expectancy of Facilities Army Construction Engineering Research Laboratory. Campaign, Illinois, April 1973.

Lincoln, L.J. Total Management of Real Property Maintenance Activities (RPMA). Office of the Chief of Engineers. U.S. Army, Washington, D.C., December 1968.

Richards, J.L. An Integrated Approach to Construction Management. Construction Engineering Research Laboratory, Champaign, Illinois, November 1973.

APPENDIX A

THE QUESTIONNAIRES

NAVAL WAR COLLEGE
NEWPORT, RHODE ISLAND
02840

11 April 1978

To: CNW Military Students

Subj: Your Opinion of Military Construction

1. I am beginning research at CAR to develop a model which will quantify the merits of military construction and alterations projects. My goal is to attempt to eliminate bias from the selection process which determines the projects to be funded.

2. The first step in developing this model is to determine the variables which impact on the decision and obtain a consensus as to the relative merits of each. Since you could be thrust in the position of Installation Commander in the not-too-distant future and have need of such a system, your help now with the attached questionnaire will assist in the development of it.

3. Return boxes are located at student station, H-85, second floor, or in the mail room.

4. Your cooperation will be greatly appreciated.

CHARLES L. SHREVES
COL, USA

1 Incl
Questionnaire

Assume you are a member of a Selection Board in Washington looking at construction projects requested by installations of all Services. Funds are going to be available for approximately 25% of the projects requested. Rate the degree of importance which you believe each variable listed below should play in the selection process.

VARIABLE	DEGREE OF IMPORTANCE (Low)						(High)
1. Improved mission accomplishment.	1	2	3	4	5	6	7
2. Safety	1	2	3	4	5	6	7
3. Command interest at several echelons	1	2	3	4	5	6	7
4. Health, welfare and morale (excluding safety)	1	2	3	4	5	6	7
5. Essentiality (National defense requirements such as special weapons storage or other mandated programs)	1	2	3	4	5	6	7
6. Cost amortization (Should more weight be given to projects which will create enough cost savings to pay for themselves in 3 years or less?)	1	2	3	4	5	6	7
7. Time restraints (Urgency of accomplishment)	1	2	3	4	5	6	7
8. External factors (Consider public relations, and local government or state requirements such as environmental aspects.)	1	2	3	4	5	6	7
9. Engineering effort (Should projects requiring less engineering effort, or where plans and specifications are already available, have priority over those not designed? This ties in with fiscal limitations that money not obligated within time limits is lost.)	1	2	3	4	5	6	7

VARIABLE	DEGREE OF IMPORTANCE (Low)						(High)
10. Distribution (Should the limited funds be spread out over many installations?)	1	2	3	4	5	6	7

Please list any other variables you believe should be considered.

11.	1	2	3	4	5	6	7
12.	1	2	3	4	5	6	7
13.	1	2	3	4	5	6	7

COMMENTS:

Assume you are a member of a Selection Board in Washington looking at construction projects requested by installations of all Services. Funds are going to be available for approximately 25% of the projects requested. Rate the degree of importance which you believe each variable listed below should play in the selection process.

VARIABLE	DEGREE OF IMPORTANCE (Low)						(High)
1. Distribution (Should the limited funds be spread out over many installations?)	1	2	3	4	5	6	7
2. Engineering effort (Should projects requiring less engineering effort, or where plans and specifications are already available, have priority over those not designed? This ties in with fiscal limitations that money not obligated within time limits is lost.)	1	2	3	4	5	6	7
3. Essentiality (National defense requirements such as special weapons storage or other mandated programs.)	1	2	3	4	5	6	7
4. Time restraints (Urgency of accomplishment.)	1	2	3	4	5	6	7
5. Safety	1	2	3	4	5	6	7
6. Health, welfare and morale (excluding safety)	1	2	3	4	5	6	7
7. Improved mission accomplishment	1	2	3	4	5	6	7
8. Cost amortization (Should more weight be given to projects which will create enough cost savings to pay for themselves in 3 years or less?)	1	2	3	4	5	6	7

VARIABLE	DEGREE OF IMPORTANCE (Low)						(High)
9. Command interest at several echelons	1	2	3	4	5	6	7
10. External factors (Consider public relations, and local government of state requirements such as environmental aspects.)	1	2	3	4	5	6	7
Please list any other variables you believe should be considered.							
11.	1	2	3	4	5	6	7
12.	1	2	3	4	5	6	
13.	1	2	3	4	5	6	7

COMMENTS:

APPENDIX B

DEPARTMENT OF THE ARMY PROJECT

EVALUATION WORKSHEETS

$1,928,000

PROJECT PRIORITY WORKSHEET

Project Description: 610. Military Ocean Terminal, Sunny Pond, N.C. Admin Atea Improvements; Provide admin, shop and covered storage area to support mobilization mission for shipping break bulk containerized ammo. If not approved, adequate facilities will not be available and sufficient terms will not exist to construct them in an emergency.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	DA requirement for mission accomplishment
Safety	1	0	Not a factor
Command Interest	4	24	High-ASAP
Health, Welfare and Morale	1	0	Not a factor
Essentiality	4	42	Essential national security requirement
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	1	0	Not a factor
External Factors	4	24	Not a factor immediately, but would be really hot if war started.
Engineering Effort	4	24	Standard Specs available
Distribution	5	24	Vital project
TOTAL POINTS		194	

$946,000

PROJECT PRIORITY WORKSHEET

Project Description: 740.21. Katterback, Germany, Commissary Warehouse Current one is diverted hanger space which is needed because of proposed move of Avn Bn to Katterback (USAREUR DIRECTED). Operation of Avn Bn and Commissary will be significantly improved. Presently dangerous mixture of commissary's vehicular and aviation traffic. Too far from commissary, wasteful hauling time.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	4	42	Aviation Mission requirement of USAREUR
Safety	3	24	Vehicular & aviation traffic together
Command Interest	4	24	Ties up move of Avn Bn
Health, Welfare and Morale	1	0	Not a factor
Essentiality	3	28	Giving back the Maintenance capability
Cost Amortization	1	0	Infor not available
Time Restraints/ Urgency	2	10	Should be done ASAP
External Factors	1	0	Not a factor
Engineering Effort	4	24	Standard Plans & Specs - AE modification needed.
Distribution	3	12	
TOTAL POINTS		164	

$6,123,000

PROJECT PRIORITY WORKSHEET

Project Description: 211. Schwaebisch Hall Army Air Field, Dolon Barrcks, Germany. Construct aircraft hanger with parking area and taxiway. There are 31 aircraft using one hanger located 1300' from runway within housing, recreation, and troop billet areas. Inadequate second hanger has no doors or heat. Safety factor for pilots and personnell in the area.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Capability improved
Safety	5	48	Possible loss of life
Command Interest	4	24	Highly desirable
Health, Welfare and Morale	4	30	Continuous exposure to cold, damp conditions in old hanger
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Info not available
Time Restraints/ Urgency	2	10	Do this year if possible
External Factors	1	0	Not a factor
Engineering Effort	4	24	Fairly standard specs
Distribution	1	0	Not a factor
TOTAL POINTS		150	

$817,000

PROJECT PRIORITY WORKSHEET

Project Description: 851.20, Fort Campebll, Ky, Woodlawn Vehicular Bridge Road. Existing bridge will not accommodate storm run-off. Present bridge approaches & pavement partially washed out by flood waters three times since 1957. Numerous traffic accidents since bridge too narrow. Two fatal injuries since 1970. Entrt to family housing area and training areas.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Affected marginally
Safety	5	48	Possible loss of additional lives
Command Interest	4	24	High - should do ASAP
Health, Welfare and Morale	1	0	Not a factor - covered by safety
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Info - Not available
Time Restraints/ Urgency	2	10	ASAP
External Factors	2	8	Community interest
Engineering Effort	2	8	No standard specs
Distribution	4	18	Extreme circumstances warrant special consideration
TOTAL POINTS		130	

$1,600,000

PROJECT PRIORITY WORKSHEET

Project Description: 740.34, Fort Benjamin Harrison, Ind. Gymnasium. 20,000 students trained annually. Existing facility overcrowded and open 95 1/2 hours per week. 3,000 individuals are limited facilities weekly.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	Not a real factor
Safety	1	0	Not a factor
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	4	30	Morale will be seriously affected if not corrected.
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	2	10	It should be accomplished ASAP
External Factors	1	0	Not a factor
Engineering Effort	4	24	Standard Specs
Distribution	3	12	Vital to Fort Ben
TOTAL POINTS		92	

$1,017,000

PROJECT PRIORITY WORKSHEET

Project Description: 740.18, Fort Polk, La. Unit Chapel. Presently using 1941 vintage temporary facility which will be demolished to clear site for FY 77 Ba-racks Project. Closest chapel 1.3 miles away from unit. Will serve 3,636 resident troops.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	Not a factor
Safety	1	0	Not a factor
Command Interest	3	16	Installation CDR & DA Chaplain interest
Health, Welfare and Morale	3	20	Morale of troops affected. Transportation to other chapels possible.
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	2	10	Should be coordinated with other construction.
External Factors	1	0	Not a factor
Engineering Effort	4	24	Standard Specs
Distribution	3	12	Placates many opposing factors
TOTAL POINTS		82	

$2,249,000

PROJECT PRIORITY WORKSHEET

Project Description: 813, Fort Lewis, Wash. Electrical Distribution System Improvement. Construct new substation to replace existing one. System is old and overloaded. 3 power outages in 1974 in one section and 60 outages on another. Can not accomplish assigned power reduction of $60,400.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	DFE mission accomplishment improved
Safety	2	12	Reasonable care during outages will prevent accidents
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	2	10	Outages cause occasional disagreeable circumstances
Essentiality	1	0	Not a consideration
Cost Amortization	1	0	Data not available
Time Restraints/ Urgency	2	10	ASAP
External Factors	1	0	Not a factor
Engineering Effort	2	8	No standard specs
Distribution	3	12	
TOTAL POINTS		82	

$140,000

PROJECT PRIORITY WORKSHEET

Project Description: 123. Korea, QM Gas Station, Camp Hamphreys. Construct gas station facilities for 4,400 vehicles per month from 36 units. Present facility substandard. Tank trailers must augment storage capacity. Located inconveniently. Space inadequate. Dispensing pumps deteriorated and can not be calibrated.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	Not a factor
Safety	3	24	Special safety rules needed to prevent this from being a factor.
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	1	0	Not a factor
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Info not available
Time Restraints/ Urgency	1	0	Not urgent
External Factors	1	0	Not a factor
Engineering Effort	4	24	Fairly standard specs
Distribution	3	12	Distribution of assets can placate many
TOTAL POINTS		76	

$3,884,000

PROJECT PRIORITY WORKSHEET

Project Description: 740.25 For Jackson, S.C., Army Continuing Education Services Center. Facilities needed to accomplish objective of AR 621-5. Presently using WWII type mobilization structure, poor lighting, no air conditioniong.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	Not a factor
Safety	1	0	Not a factor
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	4	30	Morale of students seriously affected
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	1	0	Not really urgent but desirable
External Factors	1	0	Others not affected
Engineering Effort	1	0	Detailed Plans & Specs required
Distribution	1	0	Not a factor - extremely large project
TOTAL POINTS		46	

$3,621,000

PROJECT PRIORITY WORKSHEET

Project Description: Fort Eustis, Virginia. Cargo Handling Training Faculity. Modernize existing break bulk facilities to provide training in containerized systems for 5 courses, 968 officers and NCO's annually. Present system no longer represents a typical operating ship.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	Improves capability
Safety	1	0	Not a factor
Command Interest	3	16	Installation Commander
Health, Welfare and Morale	1	0	Not a factor
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Info not available
Time Restraints/ Urgency	1	0	Not urgent
External Factors	1	0	Not a factor
Engineering Effort	1	0	Detailed plans required not standard
Distribution	1	0	Not a factor
TOTAL POINTS		44	

APPENDIX C

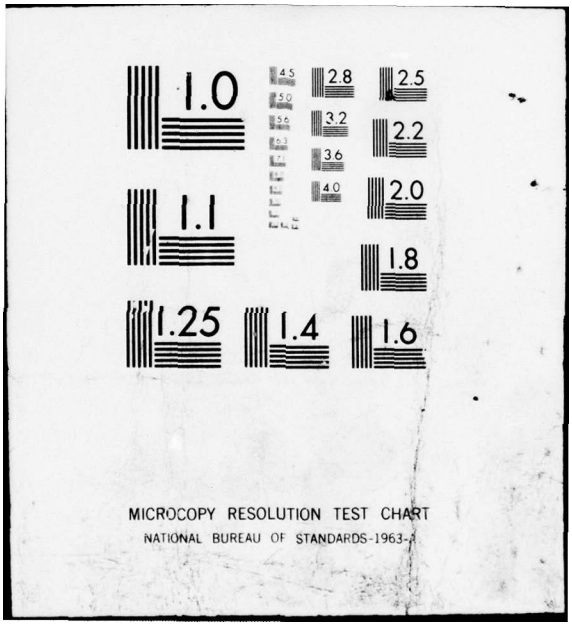
FORT DEVENS PROJECT EVALUATION WORKSHEETS

AD-A058 240 NAVAL WAR COLL NEWPORT RI CENTER FOR ADVANCED RESEARCH F/G 5/1
MAXIMIZED BENEFITS FROM MILITARY CONSTRUCTION APPROPRIATIONS.(U)
JUN 78 C L SHREVES

UNCLASSIFIED NL

2 OF 2
AD
A058240

END
DATE
FILMED
10-78
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FORT DEVENS #2 $75,000

PROJECT PRIORITY WORKSHEET

Project Description: Erect POL storage building at Fort Devens airfield to meet minimum fire prevention standards. Deficiencies were noted during Physical Security Inspection 6 Aug 74. Cost $75,000

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	Not a factor
Safety	5	48	Serious injury to personnel possible
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	1	0	Not applicable
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not applicable
Time Restraints/ Urgency	2	10	Should be accomplished during fiscal year
External Factors	1	0	No one outside of requesting service affected
Engineering Effort	4	24	Standard Specs available
Distribution	5	24	Important project to continue service
TOTAL POINTS		122	

FORT DEVENS #4 $25,000

PROJECT PRIORITY WORKSHEET

Project Description: Renovation of Classrooms, Education Center.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Could handle additional students
Safety	1	0	Not a factor
Command Interest	2	8	
Health, Welfare and Morale	4	30	Seriously affects morale
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	1	0	Not a factor
External Factors	3	16	Off duty education facilities cause unfavorable comments by college instructors.
Engineering Effort	2	8	Modification specifications required
Distribution	3	12	Vital project
TOTAL POINTS		88	

FORT DEVENS #5 $1,500

PROJECT PRIORITY WORKSHEET

Project Description: Install hooded exhaust in color photo lab and large exhaust fan in black/white lab to meet health requirements.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	Productivity will be improved
Safety	3	24	Can only work specified lengths of time or unsafe.
Command Interest	4	24	Should be done this year
Health, Welfare and Morale	4	30	Continuous exposure to particularly disagreeable fumes.
Essentiality	1	0	Not a consideration
Cost Amortization	1	0	Not a consideration
Time Restraints/ Urgency	1	0	Not a consideration
External Factors	1	0	Not a consideration
Engineering Effort	5	32	Engineering effort minimal
Distribution	4	18	Extreme circumstances
TOTAL POINTS		156	

FORT DEVENS #6 $5,000

PROJECT PRIORITY WORKSHEET

Project Description: Construct physical training facility adjacent to 10 Special Forces Group Motor Pool to include 50'x75' roofed area with horizontal ladders, and pull up bars.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Physical fitness mission accomplishment will be improved.
Safety	2	12	
Command Interest	2	8	
Health, Welfare and Morale	4	30	Morale affected because of lack of a facility
Essentiality	1	0	Not a consideration
Cost Amortization	1	0	Not a consideration
Time Restraints/ Urgency	1	0	Not a consideration
External Factors	1	0	Not a consideration
Engineering Effort	4	24	Standard plans & specs available
Distribution	3	12	Vital to unit - spreads wealth
TOTAL POINTS		100	

FORT DEVENS #7 $6,250

PROJECT PRIORITY WORKSHEET

Project Description: Convert Room 204 to a Magnetic Tape Vault. Existing room is too small. MISO tapes must be stored in a magnetic tape vault UP AR 18-7.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	DA requirement
Safety	1	0	Not a factor
Command Interest	3	16	
Health, Welfare and Morale	1	0	Not a factor
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	2	10	Accomplish this fiscal year
External Factors	3	16	DA influence
Engineering Effort	3	16	In-house work
Distribution	2	6	
TOTAL POINTS		120	

FORT DEVENS #9 $10,000

PROJECT PRIORITY WORKSHEET

Project Description: Alterations are required for the War Room, S-2 working area, and vault to meet the criteria for a sensitive area as required by AR 381-14 and recommended bt HQ, FORSCOM.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	DA requirement. Other facilities are not available.
Safety	1	0	Not a factor
Command Interest	4	24	Would be even stronger if a security violation occurred.
Health, Welfare and Morale	1	0	Not a factor
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	2	10	Accomplish this fiscal year
External Factors	1	0	Not a factor
Engineering Effort	2	8	Detailed plans required
Distribution	4	18	Important project
TOTAL POINTS		116	

FORT DEVENS #12 $4,000

PROJECT PRIORITY WORKSHEET

Project Description: Alterations to isolate Law Library from rest of office so that military attorneys can perform law research in the proper quiet and professional atmosphere.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	
Safety	1	0	Not a factor
Command Interest	2	8	
Health, Welfare and Morale	4	30	Continuous noise interferes with work
Essentiality	1	0	Not a factor
Cost Amortization	1	0	Not a factor
Time Restraints/ Urgency	2	10	Accomplish this year
External Factors	1	0	Not a factor
Engineering Effort	3	16	In-house project
Distribution	3	12	
TOTAL POINTS		104	

FORT DEVENS #13 $6,500

PROJECT PRIORITY WORKSHEET

Project Description: Alteration of Finance building to relocate three cashier cages. This will reduce lost time in carrying vouchers by customer service employees and create a concentrated Customer Service area.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	Very inefficient operation will be improved more than 1/3
Safety	1	0	Not a factor
Command Interest	2	8	
Health, Welfare and Morale	3	20	Morale will be improved by increased satisfaction with performance
Essentiality	1	0	Not a consideration
Cost Amortization	1	0	Info not available
Time Restraints/ Urgency	1	0	Not urgent, but should be done
External Factors	1	0	Not a factor
Engineering Effort	2	8	No plans available
Distribution	2	6	Distribute the wealth
TOTAL POINTS		70	

FORT DEVENS #15 $70,000

PROJECT PRIORITY WORKSHEET

Project Description: Alterations to allow consolidation of Training Audiovisual Support Center facilities as required by FORSCOM Supplement 1 to AR 108-2. Project will increase efficiency and improve coordination.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	4	42	Forscom requirement
Safety	1	0	Not a factor
Command Interest	4	24	Should be done this year
Health, Welfare and Morale	1	0	Not a factor
Essentiality	1	0	Not a consideration
Cost Amortization	2	8	
Time Restraints/ Urgency	2	10	
External Factors	1	0	Not a factor
Engineering Effort	1	0	Detailed plans & specs required
Distribution	1	0	High dollar value would not allow Many other projects
TOTAL POINTS		84	

FORT DEVENS #20 $20,000

PROJECT PRIORITY WORKSHEET

Project Description: Improve motor pool of 10th Special Forces Group by installing two additional bay doors in T-2517 and construct one additional paint and welding bay. Maintenance area would be increased by 35%. Safer operations for winter maintenance.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	Capability improved by 35%
Safety	2	12	Reasonable care will prevent accidents
Command Interest	2	8	Expressed interest by CDR at two levels higher than requesting unit
Health, Welfare and Morale	3	20	Exposure to cold in winter while performing maintenance outside
Essentiality	1	0	Not a consideration
Cost Amortization	2	0	Proper utilization of maintenance facilities and mechanics allowed by project will amortize cost in 3 years.
Time Restraints/ Urgency	1	0	Not urgent
External Factors	1	0	Others not affected
Engineering Effort	4	24	Small modifications needed to standard specifications
Distribution	3	12	
TOTAL POINTS		104	

APPENDIX D

FORT BENNING PROJECT EVALUATION WORKSHEETS

1. Fort Benning $3,772,000 Cat Code 851

PROJECT PRIORITY WORKSHEET

Project Description: Highway crossing - US 280 - Present road, Custer Road, passes under US 27-280 thru a twin box culvert 11' wide x 18'8" high tubes. Overloaded highway causes dangerous bottleneck. This road bridge would provide safe and adequate access from main post and Columbus, GA to the sand hill training complex now being constructed ~~for one station unit training. Water collects in culverts now.~~

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	
Safety	3	24	Strict compliance with safety rules required
Command Interest	4	24	Strong enough to make accomplishment this year desirable.
Health, Welfare and Morale	3	20	Disagreeable conditions
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	Should do this year
External Factors	2	8	Local community will be affected
Engineering Effort	1	0	Detailed plans & specs would be accomplished by contract through the Savannah District Engr Office
Distribution	1	0	Not a factor
TOTAL POINTS		86	

2. Fort Benning $6,687,000 Cat Code 141

PROJECT PRIORITY WORKSHEET

Project Description: Construct Reception Station (Admin & Processing Center) for enlisted trainees. Present facilities are 1941 vintage mobilization-type buildings. Wide dispersion and deteriorated conditions make major rehabilitation impractical. Expanded mission assigned to Fort Benning to receive 660 trainees per week.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Capability improved - Data not available to say how much
Safety	1	0	
Command Interest	3	16	Installation CDR
Health, Welfare and Morale	3	20	Disagreeable conditions
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	This year
External Factors	3	16	Improved publicity for recruiting possible
Engineering Effort	4	24	
Distribution	3	12	
TOTAL POINTS		112	

3. Fort Benning $7,183,000 Cat Code 721

PROJECT PRIORITY WORKSHEET

Project Description: Receptee Bks and Dining Facility - 660 Man - construct permanent facilities. Presently using WWII vintage facilities.

Rating same as for Reception Center.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	
Safety	1	0	
Command Interest	3	16	
Health, Welfare and Morale	3	20	
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	0	
External Factors	3	16	
Engineering Effort	4	24	
Distribution	3	12	
TOTAL POINTS		112	

4. Fort Benning $8,340,000 Cat Code 214

PROJECT PRIORITY WORKSHEET

Project Description: Construct permanent facilities for Brigade Tactical Equipment Shop (197th INF BDE). Would consolidate all maint facilities for one Bde fpr vehicles and equipment maintenance. Present facilities are WWII vintage. Poor working conditions in winter. Facilities 7 miles away from unit.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	3	28	Maintenance mission capability will be improved more than 1/3
Safety	2	12	Reasonable care will prevent accidents
Command Interest	3	16	Installation CDR interest
Health, Welfare and Morale	4	30	Disagreeable conditions
Essentiality	1	0	
Cost Amortization	1	0	Info not available
Time Restraints/ Urgency	1	0	
External Factors	1	0	
Engineering Effort	4	24	Standard specs available to Eng District
Distribution	3	12	Vital to unit
TOTAL POINTS		122	

5. Fort Benning $15,988,000 Cat Code 721

PROJECT PRIORITY WORKSHEET

Project Description: Construct 2 barracks, 3 story, masonry, for 1100 enlisted trainees. Operation of an Army Training Center is new mission and adequate facilities are not available. Old WWII vintage building presently being used. Poor conditions. Extra cost for energy.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	Mission assigned that can't be accomplished satisfactorily without project.
Safety	1	0	
Command Interest	3	16	Installation CDR
Health, Welfare and Morale	3	20	
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	Should do this year
External Factors	3	16	Improved publicity for recruiting possible
Engineering Effort	4	24	
Distribution	4	18	Special consideration warranted
TOTAL POINTS		160	

6. Fort Benning $4,436,000 Cat Code 422

PROJECT PRIORITY WORKSHEET

Project Description: Construct 23 igloos for storage of ammunition. Presently, 9 facilities constructed in 1942 are in violation of safety and security guidelines AR 190-11.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	DA program for security
Safety	5	48	Possible loss of life
Command Interest	5	32	DA interest
Health, Welfare and Morale	1	0	
Essentiality	2	14	Improve US position
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	Do this year
External Factors	3	16	An accident or a break in could cause severe unfavorable publicity.
Engineering Effort	4	24	
Distribution	5	24	Urgent defense requirement
TOTAL POINTS		224	

7. Fort Benning $367,000 Cat Code 730

PROJECT PRIORITY WORKSHEET

Project Description: Construct a three staff, two company fire station. AR 420-90 requires no more than a 2-mile run to hospital and 5-mile run to other troop and family housing areas. All are now being violated.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	4	42	Can not be accomplished within time limits without this project.
Safety	5	48	Possible loss of life or damage exceeding cost of this facility possible.
Command Interest	3	16	Installation CDR
Health, Welfare and Morale	1	0	
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	Do this year
External Factors	1	0	
Engineering Effort	4	24	
Distribution	3	12	Vital
TOTAL POINTS		152	

8. Fort Benning $2,103,000 Cat Code 740

PROJECT PRIORITY WORKSHEET

Project Description: Construct Enlisted Service Center in the new Sand Hill area where troop facilities are being constructed. Will provide a central location for trainees to spend off-duty time. New mission assigned to Fort Benning to train the basic infantry soldier. Presently using WWII vintage buildings.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	1	0	
Safety	1	0	
Command Interest	3	16	Installation CDR
Health, Welfare and Morale	3	20	Present facilities are somewhat disagreeable
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	1	0	
External Factors	1	0	
Engineering Effort	1	24	
Distribution	1	0	
TOTAL POINTS		60	

9. Fort Benning $452,000 Cat Code 124

PROJECT PRIORITY WORKSHEET

Project Description: Install additional underground fuel oil storage tanks in order to provide a 30-day supply of fuel oil for 218 heating plants as required HQ DA MESSAGE.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	5	56	DA requirement
Safety	1	0	
Command Interest	4	24	Strong - do this year
Health, Welfare and Morale	1	0	
Essentiality	1	0	
Cost Amortization	1	0	Info not available - could be worked up and may gain 8 points
Time Restraints/ Urgency	1	0	Not urgent
External Factors	1	0	
Engineering Effort	5	32	Minimal effort for design
Distribution	2	6	
TOTAL POINTS		118	

10. Fort Benning $2,096,000 Cat Code 218

PROJECT PRIORITY WORKSHEET

Project Description: Construct Range Control Complex (Range control office, supply & storage buildings, & maintenance building). Existing temporary facilities inadequate to control the hundreds of ranges and courses on the reservation and is poorly located near western extremity of the 70,000 acres utilized. New one would be in center.

Project Rating Factors	Evaluation		Justification/Reason
	Degree	Points	
Improved Mission Accomplishment	2	14	Improvement
Safety	3	24	Close supervision required
Command Interest	3	16	Installation CDR
Health, Welfare and Morale	1	0	
Essentiality	1	0	
Cost Amortization	1	0	
Time Restraints/ Urgency	2	10	Do this year
External Factors	1	0	
Engineering Effort	4	24	Standard buildings
Distribution	3	12	
TOTAL POINTS		100	

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Maximized Benefits from Military Construction Appropriations.		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Shreves, Charles L., COL, USA		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Center for Advanced Research Naval War College Newport, Rhode Island 02840		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Center for Advanced Research Naval War College Newport, Rhode Island 02840		12. REPORT DATE June 1978 13. NUMBER OF PAGES 115
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Unlimited

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

Unlimited

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

CONSTRUCTION; MANAGEMENT; MODELS; OPTIMIZATION; PLANNING; PLANNING AND SELECTION; QUANTIZATION; VARIABLE PARAMETERS; VARIATION

410 268

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Commanders of military installations, commands and departments must select their most important construction projects each year since appropriations (military construction, minor military construction, and operations and maintenance) are never adequate to fund known requirements. The selection process is normally based on subjective analysis which is influenced by the biases of individuals and the passion with which a requestor pleads his case. Research was conducted of the systems used at military installations, major commands and major claimants, Department of the Army and Navy, and in the

(OVER)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

(cont)

private sector. Variables which affect the selection process are evaluated and incorporated into a model which quantifies the merits of a project through examination of all major parameters which impact on the decision.

1473B